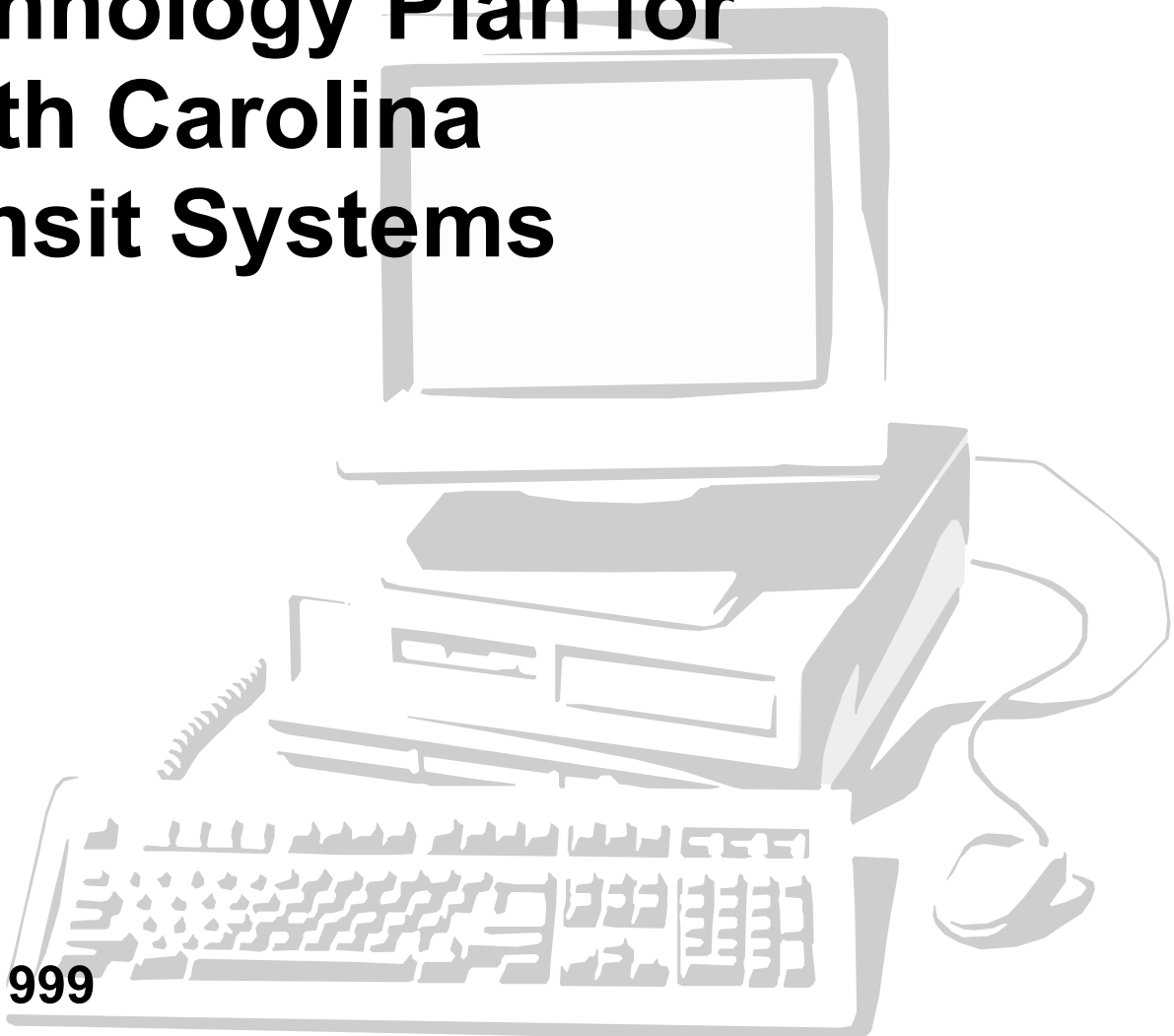**North Carolina State University**

Institute for Transportation Research and Education (ITRE)

Transit Operations Group (TOG)

Technology Plan for North Carolina Transit Systems

June 1999

Technology Plan for NC Transit Systems
Executive Summary

Transit's Growing Importance

The importance of transit service is rapidly growing. As the funding for highways becomes more limited and congestion builds on our highways, transit becomes an increasingly important ingredient to maintain economic development, offer transportation alternatives to all citizens and sustain a desirable quality of life. In fact, transit is often the only transportation choice for many in our growing workforce.

This growing importance is reflected in the Transit 2001 Plan. This visionary plan commits North Carolina to:

❑ Improve, expand and link transit service in rural, urban, and intercity settings;
❑ Leverage transit investments and provide new tools to local officials to guide development;
❑ Apply new technologies to transit where they are appropriate and cost-effective; and,
❑ Link public transportation, highways, bikeways, and sidewalks into a single seamless, multi-modal transportation network.

The North Carolina Legislature has backed up this commitment with $60 million in funding over the last two years to implement the Transit 2001 objectives.

Changing Customer Expectations

Over the same time period, the expectations for service quality and access are changing. Leaps forward in computers, the Internet, telecommunications, and other types of digital technology have taught consumers to expect the delivery of fast, accurate information on demand and more customer-focused services. The effective integration of diverse types of services will become the main focus along with earlier objectives concerning quality and re-engineering. The most successful organizations will be those that effectively integrate a variety of services and get relevant information about and to their customers at the greatest speed.

The Role of Technology

Technology is a key ingredient in the solution to make North Carolina transit systems safer, more efficient, and more effective. It will provide services that meet the quality standards set by today's consumers. Technology provides more and better-organized information into the decision-making process of transit managers and staff so they are able to make faster, informed decisions in the use of their resources. Furthermore, it provides customers with the timely, accurate information they need in order to make their own travel decisions and to make better travel plans.

American corporations have applied technology to every industry in order to improve the customer service and system efficiency to a level needed to compete in the increasingly competitive global markets. Transit system applications of technology have proven equally as profitable. Studies sponsored by the Federal Transit Administration, including a rural transit technology project completed by NC State University, have concluded technology has wide reaching applications in transit for improving safety, efficiency, effectiveness, and customer service.

A New Way of Doing Business

The adaptation of new technologies and the linking of different transit systems and transportation modes require a whole new way of doing business for the transit industry. Implementation of new technology requires well developed business and management practices. Combining new technologies with better business methods will produce a quality service and a high level of output efficiency. For example, a transit system that uses effective policies and manual routing and scheduling to meet customer travel needs is likely to realize much benefit from implementing scheduling or routing software, automated farebox systems, or customer smart cards. A method must be in place and management must be committed to utilize and take advantage of additional information that new technologies will produce with increasing accuracy and timeliness.

Therefore, this technology plan addresses more than just technology. It addresses the improvement of transit business and management practices, employee skills, and the development of a customer focus. For many in the transit industry, this shift in focus represents a new way of doing business. These improvements are a necessary ingredient to fully realize the benefits from new technologies, and to enable benefits to help lead the way in meeting the transit goals of the public, elected officials, and transit professionals.

Lessons Learned

Fortunately, leaders in the transit industry do not have to start from scratch. Besides the lessons that major corporate industries have learned while adapting to increasing international competition and adopting new technologies, there are many lessons specifically from transit itself. These lessons have been well documented and the most comprehensive and succinct representation comes from the article "Top Ten Lessons Learned in ITS Employment" in the July/August 1998 issue of ITS World in which a close examination of a dozen intelligent transportation systems (ITS) projects around the United States reveals the factors required for successful implementation. Those factors, in order of importance, are as follows:

1. Prepare for Institutional Challenges—the greatest challenges to successful deployment are very often institutional rather than technical;

2. Designate a Champion—a visionary leader at the executive level must champion the changes;

3. Define a Vision for Your Agency—the wants, needs and desires of the customers must be the basis for the plan;

4. <u>Plan for the Long Term</u>—ITS strategies must be flexible enough to handle changing short-term priorities without losing sight of the ultimate goal;

5. <u>Develop Channels for Internal Communications</u>—the planning, operating and other personnel in the different functions must communicate among themselves;

6. <u>Define Systems Requirements First</u>—a detailed and comprehensive understanding of system requirements is needed before solutions can be developed and implemented;

7. <u>Invest in Initial and Continued Learning</u>—gaps between understanding and expectations lead to increased costs and confusion;

8. <u>Develop and Carry Out Extensive Public Outreach</u>—an effective outreach program extends through the project life because the system continues to change and the public understanding needs reinforcement;

9. <u>Ensure Regional Integration and Interoperability</u>—great ITS benefits are realized through inter-agency cooperation; and,

10. <u>Ensure Compatibility with the ITS National Systems Architecture</u>—this national ITS blueprint provides a useful development guide and ensures easier integration among local, regional and national systems.

Goals

The Institute for Transportation Research and Education has developed this Technology Plan for North Carolina Transit Systems. The plan is drawn from the <u>Transit 2001</u> vision of how North Carolina transit system must change and from the lessons the transit industry and competitive corporations have learned while changing the way they do business and implementing new technology. The basis of the Technology Plan is four broad goals and their related objectives. A detailed table that includes activities, responsibilities and products for each goal is attached to this summary.

<u>Develop a Customer Focus</u>
As global economic competition has increased over the last few decades, those businesses that focused on customer needs and service have flourished. Likewise, the effectiveness of transit and its integration with the larger transportation network depend on a customer focus. The transportation needs of our citizens, the customers, are rapidly changing because of continued residential and employment suburbanization, increased traffic congestion, changing air pollution standards, and new solutions to unemployment and welfare. It is important to continually evaluate and develop services to appeal to both new and existing transit markets. In contrast to this growth in transportation alternatives, the ridership in some North Carolina transit systems has stagnated or even declined the last several years.

The Customer Development objectives are:

❑ Build consensus among community members and local, state and national elected officials;
❑ Retain existing customers; and,
❑ Attract new customers.

Develop and Implement Best Business Practices

There is one constant in life—change. As the transit environment and technologies continue to rapidly change, even the best run, most effective and efficient transit system must continually evaluate itself and make the required adjustments to remain the best. This change in business practices requires great organizational will on the part of the transit system to continually evaluate itself and to be committed to implementing needed changes. In fact, for many businesses, technology projects become an opportunity to examine current business practices and make changes to those practices that not only improve the overall organization, but also offer exceptional advantages for realizing benefits from new technology.

The Best Business Practices objectives are:

❑ Evaluate critical success factors -- Conduct Organization Fitness Review™ , preferably by an objective outside professional, to assess fitness of employees, policies, technology, equipment, etc. to serve customer needs;
❑ Identify areas for improvement;
❑ Implement recommended improvements; and,
❑ Complete standard transit procedures and improvements—use Transit Management System (TMS) to assist managers in planning projects and making efficient use of staff and resources (The TMS focuses on the key management functions and practices that are transit industry standards for attaining quality services).

Develop Leadership, Management and Technological Skills of Transit Professionals

The foundation for implementing best business practices and new technologies in transit is a well-trained, motivated work force of managers, professionals and employees. The transit workforce must let go of traditional ways of doing business and adopt new customer-focused management concepts and learn new advanced technologies—this radical change requires effective leadership.

The Professional Development objectives are:

❑ Build leadership among executives and managers that is needed to promote and implement new business practices and form new coalitions—use the Transportation Leadership Development Program and other effective personal development programs;
❑ Develop new management, professional and employee skills to change to a customer focused business approach and enable the adoption of new technologies;
❑ Master basic computer capabilities; and,
❑ Expand knowledge and capabilities in advanced transit technologies.

Deploy Appropriate Technologies

The change in organizational focus and the development of management and technical competency described in the first three goals of this plan build the foundation for deploying technologies.

The Technology Deployment objectives are:

- ❑ Evaluate and deploy baseline technologies each fiscal year;
- ❑ Evaluate and deploy appropriate advanced technology needs for most recent fiscal year; and,
- ❑ Develop local/regional multi-modal ITS plans.

North Carolina Technology Plan

System Category

The starting point for the Plan is to show which technologies are appropriate for the various transit systems within North Carolina. The Plan groups the diverse transit systems into six categories based on similarities in their operations base:

- • 1A. Small Rural
- • 1B. Medium Rural
- • 2A. Regional Rural
- • 2B. Small Urban
- • 3A. Medium/Large Urban
- • 3B. Regional Urban

These categories are a starting point—a system can move to a different category, for instance, by developing an unusually ambitious vision or by becoming part of a regional, multi-modal ITS plan.

The Appendix B to the Technology Plan, "NC Transit Systems: Technology Deployment Categories" shows the current category status of all North Carolina transit systems.

Proposed Technologies

The Appendix A to the Technology Plan, "Technology Plan for NC Transit Systems Map" shows the proposed technologies for different transit system types.

The columns in the Technology Plan map show the proposed technologies for implementation in each category. A transit system would generally start by implementing the technologies at the bottom of the column, such as voice mail and email, and progress up the column to implement progressively more complex technologies to support more specialized transit management needs. This plan does not propose to replace existing basic systems, such as telephones and computers, if they are already performing adequately.

Baseline—The first several technologies are considered baseline because these form the foundation on which all other technologies will be built. For instance, a

transit system cannot take advantage of GIS or Accounting Templates without the needed computer upgrades. Even the least complex transit system will implement and benefit from baseline technologies. These technologies are considered basic standards for doing business as a transit provider.

Advanced Technologies—Once a system has properly implemented baseline technologies, they will develop system and/or regional ITS plans. Advanced technologies will be implemented in selected systems based on criteria such as the leadership strength, commitment to adopt new business practices and quality of the individual and regional ITS plan. These technologies require higher levels of system integration, staff training and management skills to properly implement, and larger customer bases to absorb their higher costs.

Elements for Success

Several essential elements must occur to assure the Plan's success:

- Transit systems must develop better business practices and adequate technical training;
- Transit systems must understand the Technology Plan and the benefits to be derived from each technology;
- ITRE and NC DOT must clearly communicate and coordinate the development activities related to this Plan and ensure that strong technical support is available to transit systems for both baseline and advanced technologies;
- Various technologies must be well planned and integrated, especially when deployment occurs in phases (i.e., scheduling efficiency and flexibility depends on tight integration among the GIS database, scheduling software and AVL system);
- Technologies must comply with the National ITS Architecture to assure integration with other technology components not only within the transit system but also among other transit and transportation systems and modes; and,
- Funding must be available—NC DOT currently has $1.5 million/year ($1 million for urban and $1/2 million for rural) to fund promising technology applications.

Implementation Timetable

The following schedule outlines the implementation stages for technology in NC transit systems:

Year One (July 1997 to June 1998)—Transit systems acquired basic computer resources and many have built GIS and GPS databases. Some advanced technologies were approved for acquisition such as computer-aided dispatching software (integrated with a GIS), automated fare collection, and automatic vehicle location systems.

Year Two (July 1998 to June1999)—Systems continued to acquire and upgrade baseline technologies, and several advanced technologies were deployed. Advanced technologies funded and or identified for implementation include: automatic fare collection devices, bus stop

annunciators, automatic passenger counters, on-vehicle data collection devices, and scheduling software integrated with a GIS. As a result of these deployments, we will have a better understanding of the implementation issues while transit managers and staff better understand technology benefits. They have begun to define a vision to integrate the various technologies, transit systems and transportation modes. This more comprehensive focus will be the basis for building a statewide, multi-modal transportation system based on common standards.

Year Three (July 1999 to June 2000)—Systems will continue to integrate baseline and advanced technologies into their current systems. New activities will take place. Systems will participate in system, as well as regional level, planning to define their technology needs. Six urban and four rural regions have been defined for purposes of developing regional plans by the state ITS Strategic Deployment Plan; in the rural areas, additional assessment may take place. Other new activities will facilitate the sharing of technology experiences and knowledge among systems. These other activities include: a GIS service bureau, a GIS user group, the systematic collection of geographic data using GPS, the collective use of a vehicle maintenance software, and pilot tests of automatic passenger counters and other on-board data collection devices, especially in rural transit systems.

Conclusions

With the development of regional and local plans, the implementation of this Technology Plan will paint a new picture for the future of transportation in North Carolina. Customers can look forward to quicker and better information as well as creativity in service delivery. Technology will guide the customer focus as our transit systems will look at a new way of doing business. Public transportation will increasingly become a vital component in our transportation and economic system through the overall goals provided by this Plan.

Technology Plan for NC Transit Systems

Categories:	1 A	1 B	2 A	2 B	3 A	3 B
	Small Rural	Medium Rural	Regional Rural	Small Urban	Med / Large Urban	Regional Urban

Advanced Technologies

Multi-Modal ITS Regional Integration

Technology	1 A	1 B	2 A	2 B	3 A	3 B
					Real Time Information	Real Time Information
					Stop Annunciators	Stop Annunciators
					AVL / Real Time	AVL / Real Time
					Interactive Voice Response Telephone	Interactive Voice Response Telephone
				Electronic Fare Collection	Electronic Fare Collection	Electronic Fare Collection
				APCs (post processing)	APCs	APCs
		Scheduling Software / Custom DBs	Scheduling Software	Scheduling Software	Scheduling Software	Scheduling Software
	Electronic Manifest	Electronic Manifest / MDT	Electronic Manifest / MDT	Electronic Manifest / MDT	Mobile Data Terminals	Mobile Data Terminals
	Client ID - Bar Codes	Client ID - Bar Codes	Client ID - Bar Codes / Mag Stripe	Client ID - Bar Codes / Mag Stripe	Client ID - Mag Stripe / Smart Cards	Client ID - Mag Stripe / Smart Cards

Baseline / Foundational Technologies

Technology	1 A	1 B	2 A	2 B	3 A	3 B
	GPS - Client Set Up	GPS - Client Set Up	GPS	GPS	GPS	GPS
	Service Bureau: GIS	Service Bureau: GIS	GIS	GIS	GIS	GIS
	Service Bureau: Maint	Service Bureau: Maint	Maintenance Software	Maintenance Software	Maintenance Software	Maintenance Software
	Templates / Accounting	Templates / Accounting	Templates / Accounting	Templates / Accounting	Templates / Accounting	Templates / Accounting
	Computer Upgrades	Computer Upgrades	Computer Upgrades	Computer Upgrades	Computer Upgrades	Computer Upgrades
	Voice Mail / Email	Voice Mail / Email	Voice Mail / Email	Voice Mail / Email	Voice Mail / Email	Voice Mail / Email

Appendix A

NC Transit Systems
Technology Deployment Categories

Category 1a: Small Rural Public Transportation Systems	Category 1b: Medium Rural Public Transportation Systems	Category 2a: Large and Regional Rural Public Transportation Systems	Category 2b: Small Urban Public Transportation Systems	Category 3a: Medium Urban Public Transportation Systems	Category 3b: Regional and Large Urban Public Transportation Systems
Alexander	Alleghany	Alamance	AppalCART	Chapel Hill	Charlotte
Anson	Ashe	Avery	Asheville	Durham	Triangle Transit Authority
Caldwell	Beaufort	Buncombe	Fayetteville	Greensboro	
Caswell	Bladen	CARTS (Regional)	Gastonia	Raleigh	
Cherokee	Brunswick	Catawba	Greenville	Winston-Salem	
Clay	Burke	Chatham	Hickory		
Dare	Cabarrus	Cleveland	High Point		
Gates	Carteret	CPTA (Regional)	Rocky Mount		
Graham	Columbus	Davidson	Salisbury		
Hoke	Cumberland	Gaston	Wilmington		
Hyde	Duplin	Guilford	Wilson		
Lenoir	Durham	Harnett			
Martin	Greene	Haywood			
Montgomery	Jackson	Henderson			
Pender	Johnston	ICPTA (Regional)			
Scotland	Lee	Iredell			
Tyrell	Lincoln	KARTS (Regional)			
Wilson	Macon	McDowell			
	Madison	Mecklenburg			
	Mitchell	Moore			
	Onslow	Nash-Edgecombe			
	Polk	New Hanover			
	Randolph	Orange			
	Robeson	Pitt			
	Swain	Richmond			
	Transylvania	Rockingham			
	Union	Rowan			
	Washington	Rutherford			
	Yancey	Sampson			
		Stanly			
		Wake			
		Wayne			
		Wilkes			
		YVEDDI (Regional)			